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Current Claims

Re: U.S. Patent Application No. 09/700,463
Inventor: Petr VISCOR et al.
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1. An article comprising

- an element having a first and a second surface, wherein

- the first surface is adapted to hold a first electrical charge, and wherein the second surface is adapted to hold a second electrical charge, the first surface being substantially parallel to the second surface, and wherein

- the element comprises a material or a material system being prepared so as to reduce electron scattering within the material or material system, and having a predetermined crystal orientation perpendicular to the first or second surface,

- means for providing an electric field across at least part of the element, said means comprising

- means for providing the first electrical charge to the first surface of the element, and

- means for providing the second electrical charge to the second surface of the element, the second electrical charge being different from the first electrical charge in order to move electrons in a direction substantially perpendicular to the first or the second surface.

2. An article according to claim 1, wherein the material or material system comprises a semiconductor material, such as silicon, germanium, silicon carbide, gallium arsenide, indium phosphide, indium antimonide, indium arsenide, aluminium arsenide, zinc telluride or silicon nitride or any combination thereof.

3. An article according to claim 1 or 2, wherein the preparation of the material or material system comprises doping the material or material system with a dopant so as to obtain a predetermined doping level.

4. An article according to claim 3, wherein the dopant comprises phosphorus, lithium, antimony, arsenic, boron, aluminium, tantalum, gallium, indium, bismuth, silicon,

germanium, sulfur, tin, tellurium, selenium, carbon, beryllium, magnesium, zinc or cadmium or any combination thereof.

5. An article according to claim 3, wherein the predetermined doping level is less than $1x10^{18}$ cm^{-3}, such as less than $1x10^{16}$ cm^{-3}, such as less than $1x10^{14}$ cm^{-3}, such as less than $1x10^{13}$ cm^{-3}, such as less than $1x10^{12}$ cm^{-3}.

6. An article according to claim 1, wherein the means for providing the first electrical charge to the first surface comprises an at least partly conductive first material or material system.

7. An article according to claim 1, wherein the means for providing the second electrical charge to the second surface comprises an at least partly conductive second material or material system.

8. An article according to claim 6, wherein the at least partly conductive first material or material system constitutes a layer having a first and a second surface, wherein the second surface is operationally connected to a first terminal of a charge reservoir and wherein the first surface is in direct contact with the first surface of the material or material system of the element.

9. An article according to claim 7, wherein the at least partly conductive second material or material system constitutes a layer having a first and a second surface, wherein the first surface is operationally connected to a second terminal of the charge reservoir and wherein the second surface is in direct contact with the second surface of the material or material system of the element.

10. An article according to claim 6, wherein the at least partly conductive first and second material or material system comprises a metal or a highly doped semiconductor material with a doping level higher than $1x10^{17}$ cm^{-3}.

11. An article according to claim 10, wherein the at least partly conductive first and second material or material system comprises gold, chromium, platinum, aluminium, copper, cesium, rubidium, strontium, indium, praseodymium, samarium, ytterbium, francium or europium or any combination thereof.

12. An article according to claim 1, wherein the electrons comprise quasi-ballistic electrons.

13. A method for providing a first type of electrons, said method comprising the steps of:

providing an element having a first and a second surface, wherein

the first surface is adapted to hold a first electrical charge, and wherein the second surface is adapted to hold a second electrical charge, the first surface being substantially parallel to the second surface, and wherein

the element comprises a material or a material system being prepared so as to reduce electron scattering within the material or material system, and having a predetermined crystal orientation perpendicular to the first or second surface,

providing means for providing the first electrical charge to the first surface of the element, and

providing means for providing the second electrical charge to the second surface of the element, the second electrical charge being different from the first electrical charge so as to move a second type of electrons in a direction substantially perpendicular to the first or second surface.

14. A method according to claim 13, wherein the material or material system comprises a semiconductor material, such as silicon, germanium, silicon carbide, gallium arsenide, indium phosphide, indium antimonide, indium arsenide, aluminium arsenide, zinc telluride or silicon nitride or any combination thereof.

15. A method according to claim 13 or 14, wherein the preparation of the material or material system comprises doping the material or material system with a dopant so as to obtain a predetermined doping level.

16. A method according to claim 15, wherein the dopant comprises phosphorus, lithium, antimony, arsenic, boron, aluminium, tantalum, gallium, indium, bismuth, silicon, germanium, sulfur, tin, tellurium, selenium, carbon, beryllium, magnesium, zinc or cadmium or any combination thereof.

17. A method according to claim 15, wherein the predetermined doping level is less than $1x10^{18}$ cm^{-3}, such as less than $1x10^{16}$ cm^{-3}, such as less than $1x10^{14}$ cm^{-3}, such as less than $1x10^{13}$ cm^{-3}, such as less than $1x10^{12}$ cm^{-3}.

18. A method according to claim 13, wherein the means for providing the first electrical charge to the first surface comprises an at least partly conductive first material or material system.

19. A method according to claim 13, wherein the means for providing the second electrical charge to the second surface comprises an at least partly conductive second material or material system.

20. A method according to claim 18, wherein the at least partly conductive first material or material system constitutes a layer having a first and a second surface, wherein the second surface is operationally connected to a first terminal of a charge reservoir and wherein the first surface is in direct contact with the first surface of the material or material system of the element.

21. A method according to claim 19, wherein the at least partly conductive second material or material system constitutes a layer having a first and a second surface, wherein the first surface is operationally connected to a second terminal of the charge reservoir and wherein the second surface is in direct contact with the second surface of the material or material system of the element.

22. A method according to claim 20 or 21, wherein a potential difference between the first and second terminals of the charge reservoir is larger than 2 volts.

23. A method according to claim 18, wherein the at least partly conductive first and second material or material system comprises a metal or a highly doped semiconductor material with a doping level higher than 1×10^{17} cm^{-3}.

24. A method according to claim 23, wherein the at least partly conductive first and second material or material system comprises gold, chromium, platinum, aluminium, copper, cesium, rubidium, strontium, indium, praseodymium, samarium, ytterbium, francium or europium or any combination thereof.

25. A method according to claim 13, wherein the second type of electrons comprises quasi-ballistic electrons.

26. A method for fabricating an article, said method comprising the steps of:

providing a semiconductor material or material system having a first and a second surface, the second surface being substantially parallel to the first surface, the

semiconductor material or material system having a predetermined crystal orientation perpendicular to the first or second surface,

providing a surface treatment to the first and second surfaces so as to reduce surface roughness,

doping the semiconductor material or material system with a dopant so as to obtain a predetermined doping level so as to reduce electron scattering within the material or material system,

providing an at least partly conductive first material or material system, said first material or material system forming a layer having a first and a second surface, wherein the second surface is operationally connected to a first terminal of a charge reservoir and wherein the first surface is in direct contact with the first surface of the material or material system of the element, and

providing an at least partly conductive second material or material system, said second material or material system forming a layer having a first and a second surface, wherein the first surface is operationally connected to a second terminal of the charge reservoir and wherein the second surface is in direct contact with the second surface of the material or material system of the element.

27. A method according to claim 26, wherein the semiconductor material comprises silicon, germanium, silicon carbide, gallium arsenide, indium phosphide, indium antimonide, indium arsenide, aluminium arsenide, zinc telluride or silicon nitride or any combination thereof.

28. A method according to claim 26 or 27, wherein the predetermined crystal orientation is the <111>, <110> or <100> direction.

29. A method according to claim 26, wherein the surface treatment comprising optical polishing.

30. A method according to claim 26, wherein the dopant comprises lithium, phosphorus, antimony, arsenic, boron, aluminium, tantalum, gallium or indium or any combination thereof.

31. A method according to claim 26, wherein the predetermined doping level is less than $1x10^{18}$ cm^{-3}, such as less than $1x10^{16}$ cm^{-3}, such as less than $1x10^{14}$ cm^{-3}, such as less than $1x10^{13}$ cm^{-3}, such as less than $1x10^{12}$ cm^{-3}.

32. A method according to claim 26, wherein the at least partly conductive first and second material or material system comprises a metal or a highly doped semiconductor material with a doping level larger than $1x10^{17}$ cm^{-3}.

33. A method according to claim 32, wherein the at least partly conductive first and second material or material system comprises gold, platinum, chromium, aluminium or copper or any combination thereof.

34. A flat panel display comprising

an article according to claim 1, the article further comprising

a layer of material being adapted to emit light at a plurality of wavelengths upon exposure of electrons, said material layer defining, in a plane substantially parallel to the first and second surface of the element, a two-dimensional matrix having one or more surface elements, each surface element being adapted to emit light at a predetermined wavelength, and

means for selectively proving electrons to the one or more surface elements in the two-dimensional matrix.

35. A flat panel display according to claim 34, wherein the material layer for emitting the plurality of wavelengths comprise an appropriate luminophors or standard colour television phosphors.

36. A flat panel display according to claim 34 or 35, wherein the emitted light comprises at least three wavelengths corresponding to at least three colours.

37. A flat panel display according to claim 36, wherein any colour may be deduced from a combination of the at least three colours emitted from the layer.

38. A flat panel display according to claim 34, wherein the emitted wavelengths corresponds to colours red, yellow and blue, or to colours red, green and blue.

39. A flat panel display according to claim 34, wherein the electrons comprise quasi-ballistic electrons.

40. A flat panel display according to claim 34, wherein the selective means comprises a pattern so as to define, in a plane substantially parallel to the first or second surface, a two-dimensional matrix of electrically controllable matrix elements, said pattern being formed of the at least partly conductive material or material system.

41. A method for exposing a film to a plurality of electrons of a first type, said method comprising the steps of:

providing a first element having a first and a second surface, wherein

the first surface is adapted to hold a first electrical charge, and wherein the second surface is adapted to hold a second electrical charge, and wherein

the element comprises a material or a material system being prepared so as to reduce electron scattering within the material or material system, and having a predetermined crystal orientation perpendicular to the first or second surface,

providing a second element, said second element being adapted to hold the film to be exposed to the plurality of electrons of the first type,

providing a patterned absorption layer, said absorption layer being adapted to absorb electrons transmitted through the first element at positions determined by the pattern,

providing the first electrical charge to the first surface of the first element, and

providing the second electrical charge to the second surface of the first element, the second electrical charge being of opposite sign compared to the first electrical charge so as to move a second type of electrons from the first surface towards the second surface, and

providing a third electrical charge to the second element, said third electrical charge having the same sign as the second electrical charge.

42. A method according to claim 41, wherein the material or material system comprises a semiconductor material, such as silicon, germanium, silicon carbide, gallium arsenide, indium phosphide, indium antimonide, indium arsenide, aluminium arsenide, zinc telluride or silicon nitride or any combination thereof.

43. A method according to claim 41 or 42, wherein the preparation of the material or material system comprises doping the material or material system with a dopant so as to obtain a predetermined doping level.

44. A method according to claim 43, wherein the dopant comprises phosphorus, lithium, antimony, arsenic, boron, aluminium, tantalum, gallium, indium, bismuth, silicon, germanium, sulfur, tin, tellurium, selenium, carbon, beryllium, magnesium, zinc or cadmium or any combination thereof.

45. A method according to claim 43, wherein the predetermined doping level is less than $1x10^{18}$ cm^{-3}, such as less than $1x10^{16}$ cm^{-3}, such as less than $1x10^{14}$ cm^{-3}, such as less than $1x10^{13}$ cm^{-3}, such as less than $1x10^{12}$ cm^{-3}.

46. A method according to claim 41, wherein the first electrical charge is provided to the first surface of the first element from a first terminal of a charge reservoir.

47. A method according to claim 41, wherein the second electrical charge is provided to the second surface of the first element from a second terminal of the charge reservoir.

48. A method according to claim 41, wherein the third electrical charge is provided to the second element from a third terminal of the charge reservoir.

49. A method according to claim 46 or 47, wherein a potential difference between the first and second terminals of the charge reservoir is larger than 2 volts.

50. A method according to claim 41, wherein the second element comprises a metal or a semiconductor material, such as silicon, germanium, silicon carbide, gallium arsenide, indium phosphide, indium antimonide, indium arsenide, aluminium arsenide, zinc telluride or silicon nitride or any combination thereof.

51. A method according to claim 41, wherein the film comprises a resist.

52. A method according to claim 41, wherein the second type of electrons comprises quasi-ballistic electrons.

53. An article comprising

an element having a first and a second surface area, wherein

the first surface area is adapted to hold a first electrical charge, and wherein the second surface area is adapted to hold a second electrical charge, and wherein

the element comprises a material or a material system being prepared so as to reduce electron scattering within the material or material system, and having a predetermined crystal orientation perpendicular to the first or second surface,

means for providing an electric field across at least part of the element, said means comprising

means for providing the first electrical charge to the first surface area of the element, and

means for providing the second electrical charge to the second surface area of the element, the second electrical charge being different from the first electrical charge in order to move electrons between the first surface area and the second surface area.

54. An article according to claim 53, wherein the material or material system comprises a semiconductor material, such as silicon, germanium, silicon carbide, gallium arsenide, indium phosphide, indium antimonide, indium arsenide, aluminium arsenide, zinc telluride or silicon nitride or any combination thereof.

55. An article according to claim 53 or 54, wherein the preparation of the material or material system comprises doping the material or material system with a dopant so as to obtain a predetermined doping level.

56. An article according to claim 55, wherein the dopant comprises phosphorus, lithium, antimony, arsenic, boron, aluminium, tantalum, gallium, indium, bismuth, silicon, germanium, sulfur, tin, tellurium, selenium, carbon, beryllium, magnesium, zinc or cadmium or any combination thereof.

57. An article according to claim 55, wherein the predetermined doping level is less than $1x10^{18}$ cm^{-3}, such as less than $1x10^{16}$ cm^{-3}, such as less than $1x10^{14}$ cm^{-3}, such as less than $1x10^{13}$ cm^{-3}, such as less than $1x10^{12}$ cm^{-3}.

58. An article according to claim 53, wherein the means for providing the first electrical charge to the first surface comprises an at least partly conductive first material or material system.

59. An article according to claim 53, wherein the means for providing the second electrical charge to the second surface comprises an at least partly conductive second material or material system.

60. An article according to claim 58, wherein the at least partly conductive first material or material system constitutes a layer having a first and a second surface, wherein the second surface is operationally connected to a first terminal of a charge reservoir and wherein

the first surface is in direct contact with the first surface of the material or material system of the element.

61. An article according to claim 59, wherein the at least partly conductive second material or material system constitutes a layer having a first and a second surface, wherein the first surface is operationally connected to a second terminal of the charge reservoir and wherein the second surface is in direct contact with the second surface of the material or material system of the element.

62. An article according to claim 57, wherein the at least partly conductive first and second material or material system comprises a metal or a highly doped semiconductor with a doping level higher than $1x10^{17}$ cm^{-3}.

63. An article according to claim 61, wherein the at least partly conductive first and second material or material system comprises gold, chromium, platinum, aluminium, copper, cesium, rubidium, strontium, indium, praseodymium, samarium, ytterbium, francium or europium or any combination thereof.

64. An article according to claim 53, wherein the electrons comprise quasi-ballistic electrons.